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THE WONDERLAND OF COLLEGE RECRUITING — PAGE THREE

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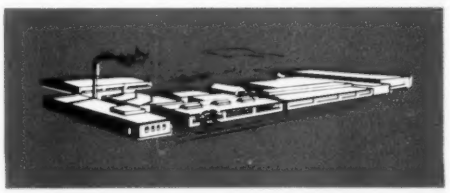

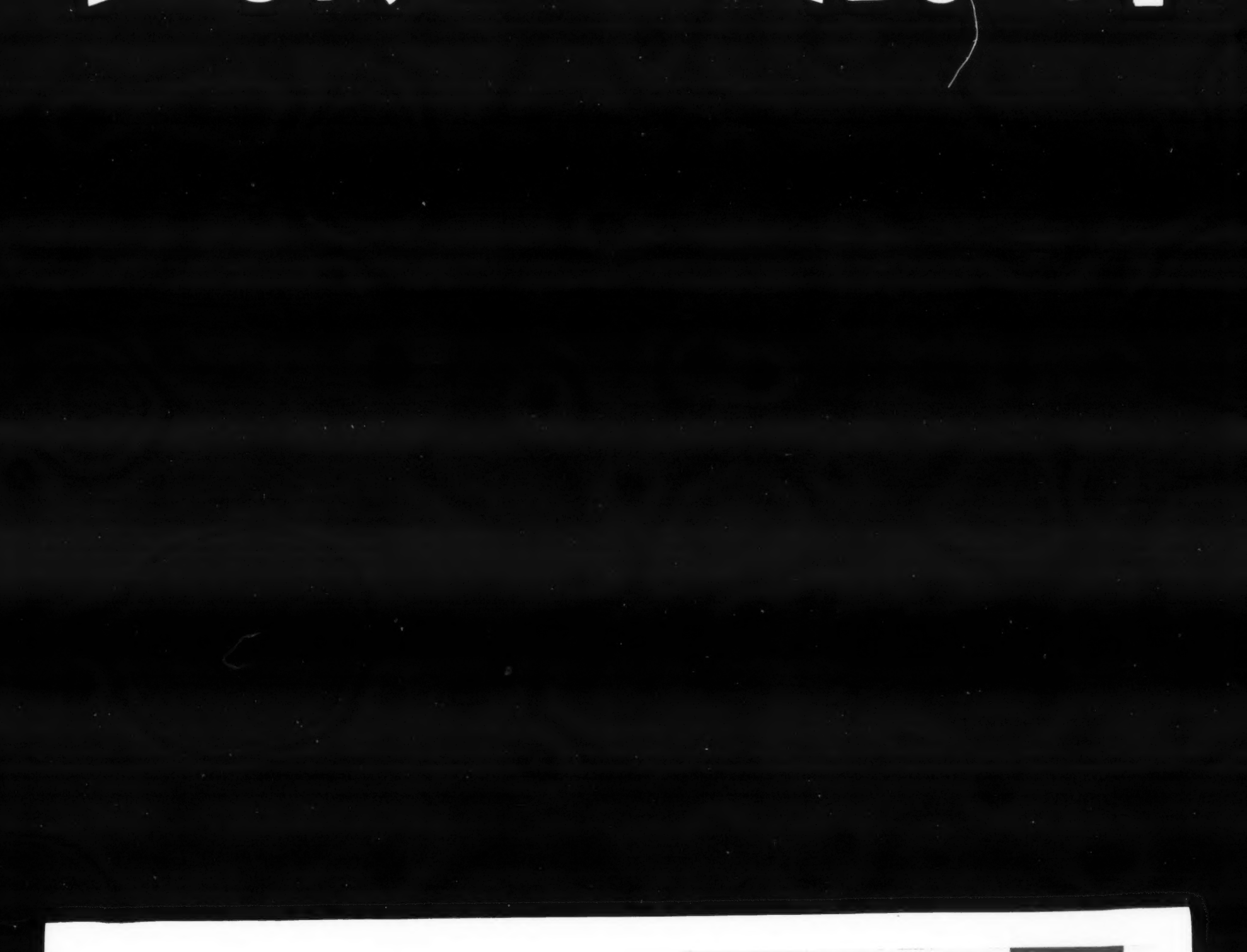

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COVER STORY

The U. S. Army Signal Corps' new mobile radar set, capable of spotting a single enemy a half-mile away in total darkness, is aptly dubbed the "Silent Sentry" and its power supply must obviously be just as quiet. The answer to the problem of providing quiet, portable power is a new fuel cell developed by National Carbon Company, Division of Union Carbide Corporation, which directly converts the chemical energy of gases such as oxygen and hydrogen into electricity. Being demonstrated at Fort Huachuca, Ariz. at the U. S. Army Electronic Proving Ground is a battery of fuel cells that silently provides power at 28 volts. The new cell is the first to operate at normal temperatures and pressures, and fills a great need for a quiet, mobile economical source of power.

—Official U. S. Army photograph

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The Wonderland of College Recruiting

by Earl C. Kubicek

Today's search for engineering talent on the campuses of America's colleges and the use of engineering talent by American industry are in many ways similar to the story of *Alice's Adventures in Wonderland*. Alice could well be today's engineering graduate who constantly is having new wonders opened to his surprised gaze, who is wondering which way to go and what he will find when he gets there. Industry has its counterpart in the White Rabbit, who runs about with watch in hand crying, "Oh dear! Oh dear! I shall be too late!"

The search for engineering talent on college campuses goes on unremittingly year after year. National publicity has lent a rather frenzied air to the whole picture. In a great many instances this has been detrimental both to industry and to the graduate applicants. Those firms who have been relatively successful in their search for engineering talent have heard themselves accused of using unfair tactics or of just plain proselyting. They also have heard themselves accused of hoarding engineering manpower. In fact, there are many who claim that there is no real engineering shortage at all but that the current situation is largely the result of stockpiling of engineers by companies with military contracts.

Actually there is dubious merit in these arguments. Who is going to sit in judgment on the opposing sides? Would it be the "haves" or the "have nots"? Those who now have engineering manpower can make a good case for their needs. Those who do not have enough personnel can present some seemingly irrefutable arguments in support of their case. It is difficult for those who are not conversant with all the aspects of the situation, its past history, present conditions, and future aspects, to arrive at a factual conclusion concerning the relative merits of the various arguments. There is no doubt, however, concerning the fact that some organizations are extremly successful in securing the engineers they need from college campuses. It also seems clear that those who do not have enough manpower will remain without it unless they are willing to do something that will change the situation.

What are the Facts

There are certain facts readily available to all. In 1955 the Engineering Manpower Commission estimated the annual needs of the country for new engineers to be between 45,000 and 75,000 for all civilian and military projects. Against these figures we can place the estimated 28,000 graduating engineers in 1958, the 31,000 in 1960, and the 35,000 in 1964. The exactness of these figures matters little. The basic point is that there is not a balance now—nor will there be a balance in the near future.

The National Society of Professional Engineers, a short while back, made a most comprehensive study of engineering personnel and their place in American industry. They studied the histories of several thousand engineers currently employed in a wide variety of organizations. The Society found that the "typical" engineer was 35 years old and has been in engineering work, with time out for military service, for nine years. They found further that he has been with his present employer, a large manufacturer, for six years. This engineer supervised five other persons, did most of his work in the office, but did go out in the field occasionally.

Was he happy? The Society found that 75 per cent of its respondents planned to shift to other fields if opportunity knocked. The most popular field, in the view of these persons, was that of private practice.

This study also showed that 87 per cent of those currently employed in nontechnical positions would prefer technical work if the opportunities for advancement were commensurate.

Less Routine Work

A study of some 500 companies having 3948 plants located throughout the country and employing 106,000 engineers showed that despite the high demand for engineers' services, some of these companies were using engineering personnel in relatively unimportant work—in work that could be satisfactorily handled by nonprofessionals. The study also brought forth, however, the fact that 85 per cent of the engineering staffs of these organizations were spending three-quarters of their time in technical engineering work. Much of the routine work formerly classified as "enginering" (routine drafting and collecting and correlating data) now was being channeled to subordinate personnel, leaving the creative work for those whose training and education fitted them for it.

We see, then, that while there is an unbalance between the estimated need for engineers and the estimated graduation of engineers by the colleges today and in the near future, and while it would seem that most large industries are beginning to make better use of their engineering staffs, the fact remains that many engineers are not in the kind of work they would like, and they are of the opinion that private practice would suit them better than the work they are now doing.

It is logical to assume that if engineers decide that they would prefer private practice after they have had some

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Mr. Kubicek is director of Alumni Relations and Placement, Illinois Institute of Technology, Chicago.
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experience in industry, it also should be possible to convince them of the advantages in going directly with a firm of consulting engineers as soon as they get out of engineering school. No doubt the reason that more of them do not go with consulting engineers lies in the fact that recruiting efforts by smaller companies are not always the best.

Small firms have come to feel, through lack of experience on their part or through some unfortunate experiences in recruiting, that it is neither logical nor practical for them to consider college recruiting. They have read or heard about the almost astronomical number of organizations seeking entree to the college campuses, and they instinctively recoil from the turmoil. This view also is shared by a few manufacturing firms who tentatively entered the field, were unsuccessful in their first ventures, and then withdrew with prejudice. They now seek refuge in specious arguments about the system.

If an organization, today, secures an adequate number of qualified additions to their engineering staff through the old "wait and see" approach, it is merely a happy coincidence. To get adequately trained and qualified engineers, a reasonable amount of time, effort, and money must be spent. This is just as logical a part of operating expense as is office rent. This is not to say that the small organization should spend six or seven months in engineering college recruiting—even though this is common enough in industry today. There are many young men on the campuses who are the type and quality of engineering personnel that firms in private practice want and need. These young men are available to anyone through the normal interviewing procedures.

Times have changed, and the young graduate does not have to place himself on the block. On the other hand, personnel, even though limited, is still available on the college campuses to those who are willing to go half way and use a rational approach.

At Illinois Tech, the placement office has aided private consultants as well as other modest sized business organizations in recruiting on the campus. The herd instinct does not always rule among engineering graduates. We have found that more than half of the graduates accept a particular employment because of the type of work rather than any of the other considerations. Last year four was the largest group of graduates from Illinois Tech to go with any one of the 500 companies who scheduled personal interviews. This proves that these graduates were not swayed by glamour of flamboyant recruiting techniques. The small firm with a limited recruiting budget can do very well. It is largely a matter of knowing how to go about it.

Work of the Placement Office

The right way to recruit is to go through the college placement office. Employers who have sought to circumvent organized procedures have found themselves on the losing end. Those who try to buy their way into private colleges have not succeeded in spite of what has been printed on the subject.

The placement officer in an organized college placement office spends a considerable amount of time, thought, and effort insuring that graduates and the representatives of business meet under the most favorable circumstances. The placement officer wants each to find out as

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much about the other as is feasible. The placement office will have personal resumés and faculty rating forms on each of the graduates available to the representatives of business when they visit the campus. The employer also will have the fullest cooperation of the faculty in that they will, within reasonable limits, be available for private consultation concerning the qualifications of individual graduates.

At Illinois Tech we arranged 2425 personal interviews between last year's graduates and the representatives of business visiting the campus—for an average of 7½ personal interviews per graduate. We recommend that the graduates limit the number of interviews arranged for them, and this means that the students only see representatives of those companies in which they are seriously interested. No one company, regardless of sizes, has too large a schedule. This system makes it reasonable to advise private consultants and other small firms to engage in college recruitment. The system set up by the placement office means that college recruiting is not expensive. is not time-consuming, but is productive —if the recruiting firm knows how to go about it.

A decade ago college recruiting, where it existed at all, was a most casual business. This led to excesses on the part of some companies then engaged in securing graduates from college. "Dropping by the campus" was the usual approach. "Looking the boys over" was common. There were few brochures available to the graduating seniors. There were, perhaps, a few annual reports or several copies of the company catalog. In many instances the company attitude was, "If you're interested—seek us out!" Little attention was given to preparation of a written explanation as to what type of opportunity existed for the graduates in the particular organization. Rarely was a letter written to the placement officer. Many companies were proud of their policy of dealing only with the top 10 per cent of the graduates.

The personal interview did not follow any set pattern beyond "getting a line on the boys." Following the interview, the applicant might hear further from the company, but if he did not measure up to someone's preconceived notion of what they thought they were looking for, that was the end of it. If the organization was a large one and moderately progressive, the applicant might receive an invitation to visit the plant—many times at his own expense.

This is not the way to go about recruiting engineering graduates today. Things are different and if the consulting engineer wants to secure qualified and available engineering personnel from colleges, he should understand recruiting techniques. First, it is necessary that the pdacement office, if it is to operate for the mutual benefit of all, have available for the graduates all pertinent information on the recruiting firm. If this is not done, the recruiters cannot expect to attract those who have no other way of learning the opportunities being offered.

Background Data

Many business organizations do not have literature prepared for this purpose, but most consulting firms do have a brochure explaining their method of operation, the type of work that they do, a list of projects, and qualifications of their current personnel. This is the kind of thing needed by the young graduate so that he may know the firm he is dealing with. Where no such material is available, a well written letter describing the activities of the firm and its opportunities will substitute for other types of material as a fine introduction. Frequently, a good letter does as well or better than the most expensive brochures.

The campus interview is usually short —perhaps 15 or 20 minutes. This initial

(Continued on page 19)

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The Last Place on Earth

In the not too distant future in an unsettled area on Cape Canaveral on Florida's east coast there will be a loud roar and in the sky there will be a streak of flame that indicates the rise of a rocket. This will not be an ordinary rocket. It will be one unique in the fact that it will be carrying the earth's first man-made satellite. Shortly after this initial blast there will be released a story that will be of interest to the entire world: "The satelite is in orbit. The first step into space and space travel has been taken."

That story, however, has yet to be written. Meanwhile, let us look at one of the many items that had to be brought into being before that earth shaking flight can take place. Let us look at the launching platform—the last place on earth where the satellite and its launching vehicle will be.

The launching platform in itself may seem at first glance to be nothing more than a lot of steel work erected on a large concrete pad. But the story behind it and its final development is quite an interesting one which actually started several years ago in an entirely different part of the country, the Army's White Sands Proving Grounds in New Mexico. It was there that the first Navy-Martin Viking rocket was successfully flown as were many later Vikings. *Viking No. 11* still holds the world's altitude records for a single stage rocket, 158 miles. This same Viking rocket design with more advanced technical philosophies and modification designed into it is the first stage of Vanguard's three stage launching vehicle for which the prime contractor is The Martin Company, Baltimore, Maryland, that will attempt to place the satellite in orbit.

As viewed from the ground, the launching pad at White Sands, appears to be a large concrete pad with a big hole in the middle. Beneath this pad and concealed by it is a pit approximately fifty feet deep and walled in on three sides with solid concrete. The rocket was erected for firing over the hole and on top of the pad. A glance towards the rocket from a short distance away gives one the impression that the rocket is sitting on the surface of the earth and pointing skyward, not unlike the Fourth of July rockets we fired when we were young.

When the rocket was fired, the exhaust gases blasted down into the pit. During firing, water was sprayed into the pit from strategically placed nozzles to aid in the cooling of the high temperature created by the blast. This launching pad was satisfactory for the White Sands area, but the rockets launched there were limited as to the horizontal distance they could travel. The White Sands range is approximately 145 miles long and for the *Vanguard* three-stage rocket the length of this range is too short. To fire the satellite launching vehicle it was apparent immediately that a new launching site must be found.

The Naval Research Laboratory, Washington, D. C., as the representative of the Department of Defense for this research project and also responsible for the earth satellite, was assigned a launching site on the east coast of Florida. Here at the Air Force Missile Test Center is a range having a length of over the 1,500 miles required by the *Vanguard* launching. Here, also, was a range that required the building of a new launching platform and all other launching facilities.

The Florida site has one great disadvantage that was not encountered at White Sands Proving Grounds. The mean ground level is approximately nine feet above the level of the ocean. A launching platform similar to that at White Sands was out of the question.

Since the firing of the first *Viking*, however, a deflector tube had been developed that would allow a rocket to be launched from a platform slightly above the surface of the ground. It required no deep pit. The basic principle of the deflector tube was to turn the rocket blast 90 degrees and instead of expending the blast energy downward would allow it to expend itself parallel with the ground surface.

The MacCallum Steel Company, Compton, California, was given a contract to build such a deflector tube designed by S & L Engineering, Los Angeles, California, compatible with the requirements of the *Vanguard* rocket. Lowey-Hydropress Division of the Baldwin-Lima-Hamilton Corporation was given a contract to design and build a supporting structure and launching platform. Their problem was to build a launching stand capable of withstanding the reactive effects of a powerful rocket at take off and the additional problem of providing a stand that could launch the entire rocket or "Static" or "captive fire" the first or the second stage without much hardware having to be changed.

The rocket supporting structure was built in two major pieces and the deflector tube was built as a third piece. Lowey built the main supporting struc-

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ture or working platform which is installed on the concrete base. This structure was designed to support the deflector tube and the adapter structures that the actual rocket first and second stages rest upon prior to launch or static firings. This supporting structure, constructed of heavy steel beams and 2 inch armor plate, is capable of withstanding a 90,000 pound thrust force. The structure stands about nine feet six inches high and measures about twenty feet by fifteen feet at the top. The total weight of the structure is about thirty tons. Accessories to this structure are flood lights, fog nozzle trees as a fire fighting protection measure, quick showers, and eye wash fountains.

During firing, the blast temperature at points on the inside surface of the deflector tube range from 3000° Fahrenheit to 5000° F. Ordinary steel would soon deform or melt under this blast temperature and force. For the deflector tube to operate satisfactorily it must be supplied with a large volume of water —about 10,000 gallons per minute. The method of operation is to have the water forced into manifolds which completely encircle the tube. Inside the deflector tube a pattern of small holes, less than ¼ inch in diameter, have been drilled directly into the manifold in such a manner that a wall of fine streams of water criss-cross the tube and completely cover the walls with a film of water under any blast condition. These streams of water serve a two-fold purpose, to cool the blast and to protect the wall of the deflector tube from the high blast temperatures.

On top of the main supporting structure is still another smaller structure. This was designed to hold the rocket directly over the top of the tube. Actually this second structure had to be made in two different types, as the tail sections of the first and second stages were different and required different types of support. These two separate structures were designed so that they could be interchanged easily as the rocket mission demanded, or so they could be replaced when that was necessary. Also incorporated into these two structures are retention members holding the rocket to the stand. In this manner the rocket engine can be fired up and tested at full thrust as necessary. This firing of the rocket engine with the retention members inserted is called Static or Captive Firing.

The above structures incorporated a weight recording system which could weigh the entire weight of the missile or measure the amount of thrust the rocket engine exerted during static firing. This is not an indication type weighing and recording instrument but a close tolerance measuring device. The amount of fuels put aboard the rocket are actually weighed by using this weight recording system.

We see, then, that although the satellite itself is a challenging problem for many engineers we also find many associated complex problems and at least one problem area, an area quite common to structural steel work, which has an interesting problem. This is typical of many of the ground problems associated with the *Vanguard*. The satellite is a challenging problem but so is the problem of Ground Support.

The last place on earth for the satellite proved to be something of a problem, but it is one that has been solved as was proven by the successful firing of the first Project *Vanguard* test vehicle on Dec. 9, 1956.

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Above, left: Incoming president, Ormas G. Smith, presents outgoing president, George L. Jackson, with the President's certificate.

Above, right: Mr. Jackson and Mr. Smith shake hands.

Below, left to right, other members seated at the speaker's table: Charles F. Murphy, E. R. Hendrickson, Frank V. Smith, and Frank W. Edwards.

Above, left to right, members seated at the speaker's table: Philip L. Coleman, Ernie A. Schmidt, John T. Rettaliata, Robert H. Bacon, John F. Sullivan, Jr., Hjalmar W. Johnson, Ormas G. Smith, George L. Jackson, W. R. Marston, J. Earl Harrington, John P. Gnaedinger, and Charles L. Mee.

The Annual Dinner of the Western Society of Engineers

The Western Society of Engineers' Annual Dinner was held on May 28 at the Society's Headquarters. After dinner, which commenced at 6:45 p.m. the meeting was opened by outgoing president, George L. Jackson.

Mr. Jackson then introduced those sitting at the speaker's table (see opposite page), then made the following remarks:

"Members of the Western Society of Engineers and Guests — Ladies and Gentlemen.

"Welcome to the 1957 Annual Meeting. I must warn you at the outset that it will be largely a business meeting with no entertainment unless something unexpected happens.

"It is time to take stock and change some officers and directors. In accordance with the old adage we are not changing horses in the middle of the stream because on Friday the fiscal year of the Society ends.

"We have had a good year and as far as my duties have been concerned it has seemed short. WSE is changing and I am sure for the better. In the new Year Book you may note some of my thoughts on its present and future status.

"By action of the Board in April WSE became an affiliate of the Engineers Joint Council. That is an organization of engineering societies whose aggregate membership is in excess of one quarter million. It is sometimes referred to as the Voice of the Engineer. More and more the Society is being asked to act as agent and coordinator for conferences and meetings. That is a part of the service we are equipped to render. An indication of the wide spread interests of the Society was the participation this spring in a conference and exhibit on school building design."

After concluding these remarks, Mr. Jackson presented awards and, after other business, introduced the incoming president, Ormas G. Smith. Mr. Smith then presented the President's Certificate to the outgoing president, and responded with the following remarks:

"I am most honored to have been selected as your president for the coming year—particularly so when I look over the roster of past presidents. Actually, I have a double reason to celebrate tonight because it's also my birthday. When I think back over the years, I am more and more convinced that this business world and any success you achieve in it is a team operation. You must join a team with your associates and particularly your family. A great deal of the success that I have had in business and in the WSE can be attributed to my wife, Elizabeth. I'd like you all to meet her.

"As we look back over the last few years, we can't help but marvel at the accomplishments of science and engineering. Thirty years ago, Lindberg flew across the Atlantic in 33½ hours. Last week, a jet plane was flown across even a longer route in 6½ hours. We have split the atom, we have the hydrogen bomb, we have radar, electronics, data processing, mechanization. In fact, today we can do almost anything we want to do through science and engineering. We have made tremendous strides and WSE has done its part in this field. But when we look back over the years and we think of our progress in human engineering, I wonder if we haven't just scratched the surface. People are the life and soul of engineering and the Western Society is made up of these same people. In my business, we are often asked, "How do you select people for supervision or management?" My approach is, "How do you pick the captain of a baseball team?" Do you pick the best pitcher, the best first baseman, etc., or do you pick the one who gets along best with his fellowmen, the one whom the team likes, yes, the one who can motivate the team to win. If the Western Society, through its activities, can help any of its members have a better knowledge and understanding of this human engineering, then I am sure that one of its most important goals will have been accomplished.

"And so, as your Board of Direction and officers guide the policies of this society, it is my hope that a year from now, we shall be able to render a report of our stewardship which will justify your faith in us."

When Mr. Smith had finished, Mr. Jackson closed the meeting by saying:

"Twenty-five years ago this month I retired as Chairman of the Junior Engineers. At that time I thought I had given the Society about all the help that I could. Little did I think that I would ever come to this moment. I hope it has been evident how much I have enjoyed serving as President of WSE. It has been a privilege and an honor that I shall not forget. I would be less than grateful, however, if I did not express my appreciation to everyone — Members, Section Officers, Committee Chairmen and to the Secretary and those of the Office Staff. To each of you I say "thanks."

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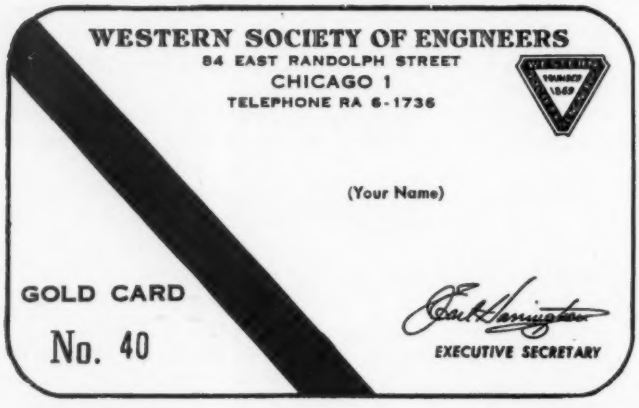

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A New Type Engine Design

A new engine design, showing promise of being one of the most important breakthroughs ever made in engine research, has opened the door to an entirely new concept in the science of internal combustion.

A radically advanced design of the free piston engine, the new power source appears to have enormous potential for almost every application.

The free piston engine produces pneumatic power, in contrast with the crankshaft engine which produces mechanical shaft power. The pistons are free to bounce in their cylinders. They are restricted by the cylinders, but not by the linkage through connecting rods for a crankshaft as are the pistons of a crankshaft engine.

The engine, possibly the most efficient user of fuel ever developed, and adaptable to burning a wide range of fuels, could replace other internal combustion engines in many areas.

The most promising immediate uses for this engine are for stationary and mobile power plants, railroad locomotives, marine power plants, farm equipment, large tractor-trailer power plants, construction equipment and other off-the-highway power-driven vehicles.

Extraordinarily effective use of the new engine can be made in the marine field. The engine is adaptable for use as an inboard power plant for almost any size craft below the level of large cargo vessels.

Power output of the prototype design ranges from 125 shaft horsepower—available from a single gasifier—up to 1,000 shaft horsepower when gasifiers are used in multiples. The range is available through the use of two types of free piston engines developed by Hamilton Division of Baldwin-Lima-Hamilton Corporation.

Both engines are products of a continuing program of research and development that led first to an efficient single-stage design—the Hamilton model DL—then to an amazingly advanced two-stage, turbocharged design—the Hamilton FP-165.

The DL uses a single stage of compression and a patented movable compressor head to produce an output of 500 shaft horsepower. DL units can be combined in multiples with one turbine to reach a peak of several thousand shaft horsepower, when turbocharged.

The new design FP-165 is a two-stage compression unit which produces 250 shaft horsepower with turbocharging; 125 shaft horsepower without turbocharging.

Analyses show that the FP-165 combines the excellent power-to-weight ratio and torque characteristics of an open-cycle gas turbine (previously the best engine in these two respects) with the economy and efficiency of a diesel. It far surpasses the diesel in torque characteristics and power-to-weight ratio.

The free piston gas turbine plant can be made directly reversible and will provide reverse power up to 65 percent of its forward power rating. This feature plus the fact that standardized gasifier units can be stacked, or combined, and connected to the same turbine, make the free piston engine ideal for marine use.

Gasifiers can be mass-produced in standard sizes and horsepower ratings. By combining outputs of several gasifiers and feeding them into a common turbine inlet, individual units can be cut in to increase power, or cut off for economy during times of low-power requirements.

A gasifier can be serviced or overhauled while the turbine is running—by cutting it off from the turbine inlet line. This is possible even with the turbine producing full power if the gasifier's output is replaced with that of a permanently connected standby.

Because of their small size and light weight, the units can be handled easily without the use of heavy cranes and other bulky tools. Thus maintenance and replacement requires minimum labor and equipment.

The model DL unit has been built and tested over the past two years. It can be produced in quantity for a wide range of applications at any time.

The FP-165 has been fully designed. Hamilton Division states that only production development and engineering are required to ready it for actual manufacture.

Advanced performance of the Hamilton FP-165 hinges on its second stage

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of compression. All other free piston engines, and Hamilton's own previous designs, have been single-stage-compression designs.

The second stage, by using the energy from the outward piston stroke, affords a balance of energies, and permits a rise in output power without excessive stress and heat on the compressor discharge valves.

Because of the inherent balance, the units are virtually vibrationless in operation and require only a minimum of foundation structure.

The majority of applications to which the free piston engine could be applied immediately are now diesel-powered. The free piston engine surpasses the diesel in these respects:

1. Has a much greater power-to-weight ratio—more power in a smaller size.

2. Burns a wider range of fuels. A diesel can burn efficiently only diesel and residual oils.

3. Can be combined so that multiple gasifiers supply one turbine to provide a wide range of power outputs.

4. Provides high-starting torque, controlled variable speed and reversibility without using the more bulky and costly transmissions and torque converters.

5. Service and maintenance costs are expected to be far less than that for diesels.

The Hamilton FP-165 engine surpasses the open-cycle gas turbine, long held to be the most desirable substitute for the diesel in most applications, in these respects:

1. Consumes half as much fuel at full load; uses substantially less than half as much at low loads and at idling speed.

2. Decelerates much faster. Requires no high-speed high-inertia compressor on the shaft that supplies output power.

3. Operates at temperatures of approximately 1000 degrees where ordinary steels can be used. The open-cycle gas turbine operates in the 1500-degree range, where special steels must be used.

4. Provides immediate high-torque characteristics. The gas turbine rotor must be operating at high enough speed to operate its integral compressor before it can supply high torque.

5. Gasifiers can be stacked or combined to supply one turbine.

The free piston gasifier produces pneumatic power, in contrast to the crankshaft engine which delivers mechanical shaft power. In the crankshaft engine, power from fuel combustion is transmitted mechanically through pistons and connecting rods to the crankshaft. The pistons of a free piston unit have no mechanical linkage—they are essentially free to bounce back and forth in their horizontal cylinders.

The gasifier power output is a hot compressed gas. Where such power containing heat is desirable or permissible, the free piston gasifier unit is tremendously versatile, flexible and economical.

The pneumatic power can be converted easily into shaft power through a turbine to provide easily controlled variable speed, high-starting torque and direct reversibility of shaft rotation. These two characteristics are not obtainable from crankshaft engines without costly and bulky torque converters, clutches and gears.

The pneumatic power from gasifiers can be used directly in a number of applications, without supplying a turbine to produce shaft power:

1. Steam plant efficiency can be increased through the use of gasifiers to pressure-feed pre-heated air to the boiler combustion chamber.

2. Auxiliary starting of aircraft turboprop and turbojet engines can be accomplished through use of the pneumatic power from gasifiers.

3. Gasifiers can be employed to generate pressured air for operation of a variety of compressed-air-driven tools.

It also is entirely feasible that impulse and hydrojet propulsion of small boats can be accomplished through use of free piston gasifiers to provide pneumatic expulsion of water from submerged tubes.

From the results obtained with free piston engines, Hamilton Division of B-L-H believes that use of free piston machinery soon will be widespread. The firm also states that large expenditures on further research and development for facilities to produce large quantities of the machines are warranted.

Jelly Beans and Atoms

Measurement of water in jelly beans, gum, marshmallows and other confections during manufacture is being made with nuclear magnetic-resonance equipment, according to *Electronics*. The method is said to be accurate, rapid, nondestructive and requires little or no sample preparation.

Important Metals

Four major metals may soon take over construction work in the automotive industry, reports *Product Engineering*. As other metals become scarcer, iron, aluminum, magnesium and titanium, plus silicon, will come to the fore.

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The Peaceful Atom at Work

With atomic bombs bursting regularly over Frenchman's Flat in the Nevada desert, and with the continuing disarmament and control of atomic weapons talk, it is easy to forget that industrial applications of atomic energy are moving quietly along.

The major step in the use of atomic energy for industrial purposes is the construction of three reactors for power and light companies. Will it be cheaper, industry is asking, to build and fuel reactors than it is to burn coal or build huge dams to harness water power?

According to Bertram C. Raynes, head of the Chemical Engineering Department of Horizons Incorporated, the Cleveland materials and process research organization, in 15 short years the nuclear technological revolution has been pursued with such imagination and skill that now it is actually the general public and the businessman who will influence greatly the next advance in the field of nuclear power production, rather than the scientist.

For a number of reasons—security, primarily—the use of nuclear energy in weapons is not a subject for general discussion. However, its use in the production of power is fast becoming both more clearly understood, and more available to the businessman and the general public.

Raynes, whose department at Horizons has handled a number of research contracts from the Atomic Energy Commission, points out that the term "nuclear power" refers to electric power generated from the energy released as heat from nuclear reaction. The consumer of electric power doesn't know what heat source was used to generate the power, and he doesn't care. He merely wants cheap electric power. By the same token, the power and light company similarly wants a cheap source of heat for the conversion into electrical power.

"The question, then, is one of economics: is it cheaper to burn coal or to 'burn' the atom?"

There is much similarity between the two processes. In each case, he indicated, heat is liberated, a furnace is needed, and ashes are formed. The atom, like coal, has become a fuel. The ashes of the nuclear fuel are reaction by-products, some of which tend to slow down its 'burning' just as coal ashes do.

The concepts are the same, and the aimed-for result is the same—power production through the conversion of heat into electrical energy. But very different furnaces are used to burn these fuels.

The furnace for nuclear fuels is called a reactor, and there are presently, two types—the homogeneous and the heterogeneous. In the latter, the nuclear fuel is contained in a corrosion resistant container, and the heat of the reaction is removed by a fluid (gas or liquid) in contact with the containers which are called the fuel elements.

In the homogeneous reactor, the nuclear fuel is actually contained in the fluid, and the fuel moves with the fluid stream to give up its heat for conversion to power, and then returns to the furnace to build up more heat. In this latter type, Horizons was instrumental in preparing the fuel for such fluid stream.

"The power and light companies will do a lot of calculating before the next group of reactors are built," Raynes said. "One of the most important distinctions between the types of reactors, and one which is of prime concern to the companies as profit-minded businesses, is the cost of reprocessing the fuel elements."

According to the Horizons department head, the ashes of a coal reaction are relatively valueless, and the furnaces are operated so as to consume all the combustibles and leave only ashes. Occasional mechanical removal of the ashes allows combustion to proceed satisfactorily. A nuclear reactor cannot burn all of its fuel at one time; the ashes are chemical elements born of the reaction and, in some instances, capable of slowing down and stopping the nuclear fire.

Complete burning of the nuclear fuel is possible only by removing these ashes periodically and returning the unused portion to the reactor. Actually, only a few percent of the nuclear fuel present at one time can be converted to power in the reactor. Some of the by-product ash elements which "poison" the nuclear reaction are valuable and include the rare earth elements and radioactive isotopes of many elements.

"This required recycle of the unburned portion of the nuclear fuel represents an operating cost which the businessman must recognize in deciding whether to build a coal burning, or which type of atom-burning electric power plant.

"The homogeneous reactor will permit continuously siphoning off a portion of the fuel stream through a reprocessing and reconstituting plant. This reprocessing can be done at the reactor site in a relatively inexpensive plant, and costs are low as compared to a plant needed to reprocess fuel elements from a heterogeneous reactor," Raynes added.

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In the case of the latter, the reactor must be shut down temporarily to remove and replace the partially burned fuel elements with fresh ones.

According to Raynes, reprocessing used elements is relatively expensive, and current thinking contemplates a central reprocessing plant to which spent elements would be sent. This requires shipping of highly radioactive materials in special transports and reshipment of the refabricated elements. Refabrication also would add to the overall expense of power production.

On the debit side of the picture, insofar as homogeneous reactors are concerned, are the added operating difficulties. Radio-active materials circulate throughout the system, adding to the shielding problem, corrosive and erosive problems and, at present at least, an inherently bulky structure.

"There will be specific applications for each reactor type in the future. For power production, for military or mobile use, it appears that the heterogeneous reactors are appropriate. They can be fitted on railroad tracks, shipboard and, as in the case of two operating submarines, go underseas. In these cases, the application will permit some additional expense in favor of size or mobility."

The homogeneous reactors, he indicated, are under vigorous study for large, stationary power plant applications. In these instances, operating costs per kilowatt hour will determine the choice of reactor type.

Raynes warned, however, that anything said about reactors should be properly dated because scientific advances can alter, in one day, all previously held concepts, and a scientific breakthrough in any of a number of areas pertaining to nuclear power plants could change drastically the assumptions now held.

For Better Traction

A chemical that can be spray-applied to railroad tracks to improve traction is on the way, *Chemical Week* publication reports. Developed jointly by Reading Company, Philadelphia, National Aluminate Corporation, Chicago, and General Electric, the compound is in an advanced stage and not yet available for sale. Its chemical makeup remains a closely guarded secret.

Highway Authorities To Present Papers

Two of America's leading highway authorities will present papers on the latest developments in the expanded United States road-building program before the International Concrete Roads Congress in Rome, Italy, Oct. 16-19.

Harold L. Plummer, chairman of the Wisconsin State Highway Commission, will be a featured speaker at the opening session of the congress on October 16.

In his speech, entitled "Motorways," Plummer will describe the expanded road-building program currently underway in the United States. In addition to describing the background and scope of the present long-range federal-aid program, the largest peacetime construction project undertaken in world history, he will discuss the newest techniques for simplifying and speeding highway design and construction.

Plummer, who became head of the Wisconsin Commission in 1952, has pioneered in techniques for reducing engineering manpower requirements for highway construction. During his tenure of office, Wisconsin's engineering manpower requirements have dropped from 10 engineers per million dollars of highway construction, to four engineers per million dollars.

He has spoken before many American audiences, describing the Wisconsin technique for reducing engineering manpower requirements. He is also currently serving as a director and regional vice

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president of the American Road Builders Association.

J. Carl McMonagle, president of the Institue of Traffic Engineers, will deliver a major paper on urban expressways during the Congress.

McMonagle, professor and assistant director of the Highway Traffic Safety Center at Michigan State University, will discuss "Urban Expressways in the United States".

His speech will emphasize past experience of metropolitan areas with this innovation in highway design, and its implications for the 2,300 miles of urban connections to be built into the National System of Interstate and Defense Highways at present under construction over the United States.

McMonagle, for 21 years director of the Planning and Traffic Division of the Michigan State Highway Department, played a major role in applying the principles of traffic engineering to the development of the Michigan highway system. During this period, Michigan highways served as a model for the development of modern highways in many states.

Among the printed papers to be distributed to the delegates to the conference will be one by James A. Foster, entitled "Durability and Low Annual Cost of Concrete Pavement in the United States." Foster, a graduate of Princeton with a degree in Civil Engineering, is a former district engineer for right-of-way of the Illinois Highway Department, and is currently assistant manager of the Highway and Municipal Bureau of the Portland Cement Association.

Other American construction authorities who will appear before the Congress include Major General Lee B. Washbourne, deputy chief of staff, Installations, of the U. S. Air Force, who will present a paper, jointly with C. M. Bell, airfield engineer, on "Concrete Runways and Airports."

The International Concrete Roads Congress is supported by organizations in more than 12 nations interested in the use and development of streets and highways. The papers at the congress will be concerned with recent technical progress and achievements in the construction of concrete roads and airfield runways.

Speeches will be translated and papers published in four languages. Photographic exhibits and documentary films will supplement the technical speeches.

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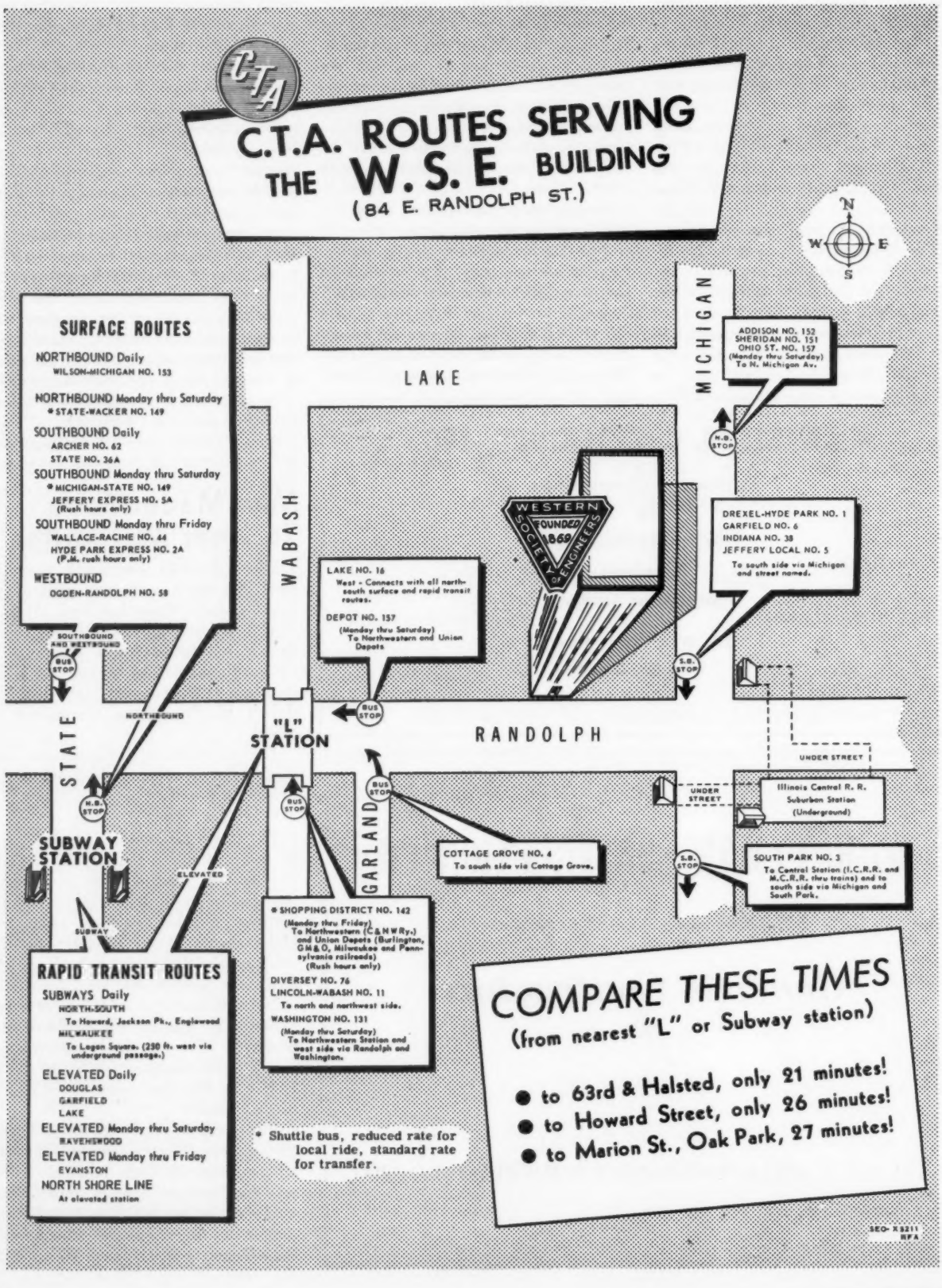
Man-Made Moon To Hear Meteorites

When the first man-made moon is fired into space, some time during the International Geophysical Year (July 1, 1957, to December 31, 1958), tiny piezoelectric microphones will "hear" collisions with microscopic meteorites. These collisions will be converted into electrical signals which will be transmitted to earth.

The piezoelectric microphones are made of a new material developed by Brush Electronics Company, Cleveland, a division of Clevite Corporation.

The Brush piezoelectric receivers will be mounted inside the satellite shell to pick up the sound of stray particles of dust impinging on the "moon." Though particles will be extremely small, the high velocity of the satellite plus the extreme sensitivity of the receivers will make the impact audible. Thus, collisions with particles weighing but a few billionths of a gram will be heard and reported. Minimum-sized particles expected to be measured will weigh 2.5 x 10^{-9}, with densities expected to be between 3 and 8.

The sound picked up by the piezoelectric receivers will be transmitted through an amplifier, through magnetic cores used for "memory" storage, into a Minitrack transmitter which will relay the signals to the Vanguard Communications Center in Washington, D. C.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College Recruiting

(Continued from page 7)

interview is an introductory period for the applicant as well as the recruiter. It is the opportunity for the recruiter to get across to the graduate the basic facts about his organization that can be told better than they can be written. It is also his opportunity to gather this same sort of factual information about the applicant. The recruiter is interested in getting information not provided by the placement office in written form. The interests, abilities, personality, and potentials of the applicant can be explored at this time.

This is the time at which the consulting engineer can explain to the student the advantages of work with a firm in private practice. This is the time to tell the student why private practice is the most professional approach to engineering. It should be understood, however, that today's engineering graduate is not naive in his unthinking acceptance of personal credos that are at variance with current conditions. The fact that *you* found it necessary to work 12 hours per day for 35 cents an hour during the depression may receive his sympathy, but it will not convince him that he should repeat your experiences.

The applicant is at the interview to learn, and the representative is there to explain and inquire. Many company representatives fail because they do not understand the art of interviewing. The company representative must know how to put the applicant at ease so that he can be seen in something approaching his usual frame of mind and personality. The prospective employee must be at ease also in order that he may appraise the organization and its opportunities in the light of his own abilities. Two strangers meet for a short passage of time to ask and answer questions, impress and be impressed, and choose or reject each other.

Frequently, one or the other will quickly show that he is not interested in getting together. When this happens, veteran campus interviewers recognize that this is no time to hurriedly break off the interview. They recognize the obligation to spend the few minutes allotted in at least offering advice to the graduate—even if they cannot offer him a position. This can be valuable to the firm, for this is an opportunity to sell the young man on private practice even if he is not currently suited for it, and it will leave a favorable impression with him that will be transmitted to other students.

The Personal Interview

Mr. Paul W. Boynton, supervisor of employment, Socony Vacuum Oil Co., a veteran in the field of college recruiting, has aptly characterized a half dozen types of personal interviews as:

**Cursory: Results in humiliation and a sense of futility for the interviewee.

**Standardized: In this instance the basic fact overlooked is that the person being interviewed is an individual. This type of interview takes no cognizance of special situations. It is based upon the absurd premise that all people react the same way.

**Chatty: A pleasant conversational type of interview in which the interviewer lets himself go and has a most enjoyable time in discussing a wide range of topics with the applicant. If not directed, it certainly will not gather the required information.

**Taciturn: The silent interviewer takes the attitude that the interviewee is present to get a job—so convince me. The picture of the man interviewed under this arrangement is not likely to emerge.

**Third Degree: The candidate, figuratively faced with a strong light and trick questions, is not likely to exhibit himself and most likely will be antagonized.

**Competent: In which the interview takes the form of a two-way conversation—not a questionaire. The conversation is skillfully and tactfully directed to insure the transmittal of the greatest amount of information, on both sides, in the time available.

The Proper Technique

This is good advice, and with just a little experience, almost any man can become a good interviewer. There are really only three steps to take:

**The applicant is put at ease so he talks freely.

**The conversation is directed toward getting the key to the applicant's interest and personality as well as discovering the qualifications for employment or for the specific position currently under discussion.

**The interview is guided by intelligently phrased questions designed to elicit the truth without being leading, misleading, or confusing.

The interviewer should, of course, know what he is looking for. The factors generally listed as important by experienced interviewers are:

**Does the applicant give a favorable impression?

**Does he seem energetic?

**Does he seem mentally alert?

**Does he seem emotionally mature?

**Does he present evidence of good judgment in discussing past activities and future plans?

**Does he seem to have growth potential insofar as the firm is concerned?

The answers to these questions will give some concept of the young graduate's personality, character, and intellectual qualities. They also will indicate his attitude, and the interviewer has an opportunity to judge his physical condition and appearance.

If the representative has been skillful in interviewing the students and if he has properly analyzed the information, he should be able to decide which, if any, of the students fit his needs. If the young

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men that he selects agree that he has the best proposition to offer, then employment is merely a matter of formally offering a job and formally having it accepted.

It can be seen that firms of consulting engineers are not really competing with the industrial giants whose lures they profess to distain. Consultants are not really competing with the glamorous aspects of research or the cradle to grave security policies of some companies. They are offering a way of life, a means of expression, an opportunity to earn a living. They are offering this young man a particular position in a special field of engineering, and young graduates are receptive to this if the ideas and concepts are presented properly.

Consulting engineer firms may not, it is true, secure all the personnel that they perhaps want or need. With few exceptions no one does that at this time. The most recent studies of college recruiting in industry show that organizations securing 58 per cent of the graduates desired are doing better than average. But engineers in private practice have so much to offer that their story should receive a good hearing by the graduates.

Pay Scales

It is understandable that consulting engineers object to the starting salaries of young graduates. So much of the cost of operation of a consulting firm is in salaries that just a small increase in salary levels greatly affects the financial well being of the company. As far as starting salaries for graduating engineers are concerned, in 1956, the over-all average for all engineers accepting employment in all types of companies in all parts of the country was $425 per month based upon a 40 hour work week. with not more than one year's work experience based on part-time or summer employment. Each graduating class at Illinois Tech over the past six years has started to work at $10 to $15 per month over the class of the previous year.

Salary, on the other hand, is not the principal motivating force in college recruitment. A $25 per month differential either way from the going rate does not seem to make much difference. We have found that if the salary offered is commensurate with the going rate, it does not even enter into the discussion. It is also true that individuals have different primary interests, and there are many graduating students who are willing to take considerably less money for a job that they are convinced offers them the right work and the proper opportunity.

Consulting engineers also should pay more attention to the making of contacts through summer employment. Part-time employment also is possible when the consultant is located in an area near an engineering college or university. Summer employment for advanced undergraduates can supplement much of the primary training. It can be a period of amalgamation on the part of the organization as well as the undergraduate. Studies conducted with each of our graduating classes have shown that previous association has much to do with a graduate's choice of work. This, in many instances, stems back to summer employment or perhaps association with others who have been or currently are with the firm.

If the consulting engineer will be consistent in his search for manpower on the campus and if he makes known the fact that work is available in consulting engineer firms, he can be sure that his approach will be as successful as any of the giant industrial organizations.

Good men are available and they can be obtained by those who are willing to face reality and seek men in the most logical place — the American college campus.

Fast Thinker

A new $8-million testing device that thinks faster than a guided missile flies will be put into operation by the Air Force in 1958, reports *Electronics*. It evaluates data as the missile flies, and allows new settings to be put in and evaluated during the same flight.

England's Nuclear Lack: Personnel

The main roadblock to England's ambitious plans for creating a gigantic nuclear power industry within the next twenty years is not a shortage of technical knowledge as has sometimes been suggested, but a scarcity of trained personnel, according to an English engineer speaking in San Francisco on June 10.

Addressing the Semi-Annual Meeting of The American Society of Mechanical Engineers, W. R. Wootton of Babcock & Wilcox Ltd., London, denied that atomic power stations built in Britain today are inefficient and would soon be obsolete, as has been contended by some experts.

Conceding that demand for coal and oil in Britain will soon exceed the available supply, and that this situation calls for rapid development of nuclear power for industrial use, he said that the present British program "is by no means a stopgap adopted by a country with a dire shortage of conventional fuels".

Contrast between Great Britain's plans for rapid development of peacetime atomic power, and America's slower, more cautious approach, has led to a sharp difference of opinion in this country. Defenders of American policy have frequently said that although nuclear power generation may be economically feasible in England, knowledge of atomic plants is not sufficiently advanced to justify large-scale construction in America of units that may rapidly become outmoded.

Wootton gave a different view, saying that plants of the current British type, with possible improvements, will still be built 25 years from now. He added that

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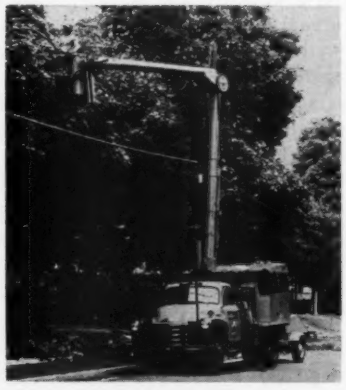

the power reactor now in operation at Calder Hall, in England, has advantages of simplicity and safety that are not inherent in more advanced types. Calder Hall has operated in a trouble-free manner, he said, and "present indications are that the expectations of designers will be fully met."

Recent proposals by British industry have rejected the idea of a slow, conservative development of reactors, and have called, instead, for construction of new units similar to Calder Hall but with four times the electrical-generating capacity. Industry has found no practical limit to the size of such reactors, the British engineer added.

Commenting on the shortage of trained engineers and scientists capable of developing atomic energy for peacetime purposes, Wootton said that this is a "most serious obstacle," but that steps have been taken to overcome it. These include establishment of a reactor school at Harwell, a major British research installation, and of industrial training programs and a Reactor Operation School at Calder Hall. In addition, many colleges have established courses in nuclear engineering and reactor technology, and two have instituted Faculties of Nuclear Engineering.

A Lot of Paint

More than five million gallons of paints and coatings will be used in 1957 for existing merchant vessels and craft under construction in private domestic shipyards, reports *Chemical Week*. The breakdown: some 3.7 million gallons for maintenance of existing merchant ships, about one million gallons for ships being built, and the remainder for foreign ships under repair in U.S. shipyards.

Gas Turbine Useful On Pipe Lines

Where economics justify remote control of natural gas pipe lines, gas turbine driven centrifugal compressors are readily adaptable to automatic sequence control, it was reported in Philadelphia on Sept. 9 at the American Institute of Electrical Engineers' Conference on the Petroleum Industry.

Such was the conclusion of three engineers in a paper entitled "Electrical Control of Gas Turbines in Gas Transmission Service." It was authored by R. A. Yannone, Westinghouse Electric Corp., South Philadelphia; A. B. Niemoller, Westinghouse, Hillside, N. Y., and F. P. Goertzen, of Texas Eastern Transmission Corp., Shreveport, La. The paper described the electric controls for a gas turbine compressor station of the Texas Eastern-Penn Jersey pipeline.

With installation of new pipe lines and additional power, the gas transmission industry continues to supply a greater percentage of the nation's fuel supply, and the newest type of plant for this service is the gas turbine driven direct connected centrifugal compressor.

The gas turbine power plant, which utilizes part of the gas that is being transmitted through the pipeline they described, "is dual shaft and employs an open type gas cycle with regenerator. The unit is rated at 5,000 H. P. at 80°F. and 1,000 ft. elevation. The dual shaft unit differs from the more common single shaft unit in that the power turbine and its load are mechanically independent of the axial compressor and its driving turbine. This provides increased flexibility over a wide speed range to handle line flow variations."

Protection Provided Against Fumes

An economical installation of self-powered, automatic safety controls—first of its kind ever made—helped a manufacturer of laboratory equipment provide needed protection against dangerous chemical fumes.

At the manufacturer's plant, metal laboratory parts are thoroughly cleaned in several three-by-five foot vapor de-greasing tanks prior to plating. Parts are lowered in baskets into five-foot-deep tanks where trichloroethylene vapors are used to remove dirt, dust, grime and grease.

Heating coils in the lower portion of the tank bring the chemical solvent to a temperature at which it vaporizes—about 120°F.

The top of the de-greasing tank is surrounded with coils containing cooling water used to condense these vapors which are considered hazardous. Any malfunction of either heating or cooling coils can cause the vapors to overflow although they are heavier than air.

To control this potentially dangerous situation, the laboratory equipment manufacturer installed a safety control device. The control, designed by the Fulton Sylphon Division of Robertshaw-Fulton Controls Company, is a simple, self-operated unit requiring no air or electricity for its operation.

In installations on steam-heated vapor de-greasers, the company said triple protection is provided.

The steam to the heating coil of the cleaning solution is fed through a valve which is triggered by the safety mechanism. The pressure element of the safety device is connected to the cooling water supply line. A thermal bulb is installed above the condensing coils. On failure of cooling water supply, the safety control will trip, thereby closing the steam heating supply.

The second safety feature of the control trips the instrument in case the dangerous vapors rise above the condensing coils for any reason.

Finally, if the sealed thermal system of the safety control is damaged or otherwise loses its charge, the de-greasing unit will shut itself off automatically.

The safety unit also can be equipped with a switch for alarm or other purposes. Resetting the safety installation is done manually.

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Tallamy to Speak at ASCE Meet

Bertram D. Tallamy, federal highway administrator; Robert Moses, chairman of the New York State Power Authority; Dr. Joseph W. Barker, president of Engineers Joint Council and chairman of the board, Research Corp.; Rear Admiral Robert H. Meade, U. S. Navy, chief of engineers, and Alfred L. Perlman, president of the New York Central Railroad, will be speakers at the Annual Meeting of the American Society of Civil Engineers in the Hotel Statler, New York City, Oct. 14-18.

Their talks will cover several major subjects of public importance and engineering interest. Dr. Barker is scheduled to address a luncheon, Oct. 14, on "Unity in the Engineering Profession," a matter that has been extensively discussed in the profession for a long time. The city's welcome will be extended at this session by Mayor Robert F. Wagner.

Moses will address the convention at an Oct. 15 luncheon on "The St. Lawrence and Niagara Power Projects," and will comment on the arterial highway progress in metropolitan New York.

Tallamy's address, on "The Engineer's Biggest Challenge," will be made at an Oct. 16 luncheon at which honorary memberships, highest distinction in ASCE, will be conferred on four engineers. Perkman will speak Oct. 16 before a Student Chapter Conference on "Working for a Firm Employing a Large Number of Engineers." Rear Admiral Meade will address an Oct. 17 luncheon.

The Technical sessions of the convention will cover a wide range of subjects, including the highway program, power projects here and in other countries, conditions of practice, sanitary engineering, surveying and mapping, engineering mechanics, hydraulics, structural engineering, waterways and harbors, construction, and soil mechanics and foundations. Papers will be presented by a number of foreign engineers, including leading civil engineers of Yugoslavia, Italy, Australia, Japan, and Sweden. A Canadian paper is scheduled. Underground power plants will be the theme of several papers.

Federal, state, county and local officials will discuss the Interstate Highway System from their respective standpoints. Speakers will include Frank Turner, deputy commissioner, U. S. Bureau of Public Roads; Rex M. Whitton, chief engineer, Missouri State Highway Commission; John B. Benson, Jr., Covington, Ala., county engineer, and James E. Lister, planning director, Cleveland City Planning Commission. The Highway Division will present, for its premiere, the U. S. Steel Corp. Film, "Jonah and the Highway," dealing with the highway engineer and his job.

A session of the Conditions of Practice Committee will hear several papers on various aspects of civil engineering education and a report by the ASCE Task Committee on Professional Education. Water supply, air pollution and industrial wastes will be discussed in Sanitary Engineering Division sessions. Navy Department representatives will speak on navigation and flood control facilities.

A joint meeting of the Society's Construction, Highway and Structural Divisions, will hear talks on developments in the metropolitan New York arterial highway system.

As part of the convention a Waterways and Harbors Division Conference will be held at Princeton University Oct. 18.

New Officers and directors will be installed at the annual business meeting the morning of Oct. 16. The official nominee for president is Louis R. Howson, MWSE of Chicago. At this meeting, too, presentations of major awards for outstanding published papers will be made.

At the Awards Luncheon that day, honorary membership will be conferred on Lorenzo Perez Castro, of Mexico City; Prof. Whitney C. Huntington, of the University of Illinois; Karl Imhoff, of Essen, Germany, and Howard S. Morse, of Indianapolis.

A convention attendance of 3,000 is indicated. Barclay G. Johnson is Convention Chairman.

Electro-Technical Societies Sponsor

How can the application of electronic and electrical investigative techniques solve the complex and pressing problems confronting scientists in biology and medicine in their day to day search for ways to insure health? This and many other questions of high interest will be answered and discussed at the upcoming Tenth Annual Conference on Electrical Techniques in Medicine and Biology, November 6-8, at the Sheraton Plaza Hotel in Boston, Massachusetts.

Sponsored jointly by the three major electro-technical societies in the U S — Instrument Society of America, American Institute of Electrical Engineers and IRE's Medical Physics Group of Boston —the conference for the past ten years has been a meeting ground for medical and physical scientists, bio-physicists, clinicians and instrument engineers. The meetings have been planned to stimulate exchange of ideas both through planned symposia and informal pre-dinner discussions. Afternoons have been left open to permit tours. The Boston area is particularly suited to a meeting of this scope since it boasts many renowned educational institutions, medical research centers, laboratories and scientific apparatus manufacturing organizations.

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Reviews of Technical Books

Vibration Analysis

Fundamentals of Vibration Analysis, by N. O. Myklestad, McGraw-Hill Book Company, Inc., New York 36, N.Y. 1956. Price $6.50.

The author has aimed at giving the reader a sound introduction to the fundamentals of vibration analysis without requiring advanced mathematical training. General principles are stressed, and classical procedures are used almost exclusively.

The author follows a more or less standard pattern of presentation, first giving attention to the undamped single degree of freedom system, then introducing damping, both viscous and non-viscous. Multi-degree systems are then introduced, along with generalized coordinates, normal modes, and the Lagrangian equations.

Throughout the text, the mathematical treatment is given in the language of the mathematics included in undergraduate engineering college curricula. This makes it possible to present the derivations to the student without extra mathematical preparation, but also makes the presentation somewhat laborious.

The discussion of energy dissipation through non-viscous damping is especially well presented.

A novel proof of the orthogonality of the modes of vibration of an undamped system is presented, in which work-energy relations are employed to establish orthogonality. This approach should appeal to the student who is meeting the concept for the first time.

The problems following each chapter are excellent.

G.V.B.

Applications of Plastics

Engineering Properties and Applications of Plastics, by Gilbert Ford Kinney, John Wiley & Sons, Inc., New York 16, N.Y. 1957. Pages, 278. Price, $6.75.

This book was written for those who work with plastics and require background information for the proper utilization or specification of these materials. This new book emphasizes an understanding of the fundamental nature of plastics and analyzes why they behave as they do.

Dr. Kinney devotes separate descriptions to the various plastics. His unified treatment, rather than a topical approach, permits the principles, concepts, and terminology to be established in the simpler cases, and is utilized in dealing with the more complex materials. The plastics covered here are: polyethylene; polyvinyl chloride; polystyrene; the acrylic plastics; other vinyl-type plastics, the cellulose plastics; phenolic plastics; the amino plastics; polyesters, polyamides, and epoxies; silicones; and the rubbers.

Separate chapters describe methods for fabrication, as well as the mechanical, electrical, optical, and thermal properties of these materials. The author also provides an abbreviated survey of the type reactions of organic chemistry. In effect, he establishes the broad background necessary to effect good design.

Dr. Kinney is professor of chemical engineering at the U. S. Naval Postgraduate School in Monterey, California.

Ideas for Management

Ideas For Management, compendium of the papers and case histories presented at the Ninth Annual International Systems Meeting, Modern Office Procedures Magazine, 812 Huron Road, Cleveland, Ohio. 1957. Pages, 744. Price, $25.00.

The material represents the latest thinking on systems and procedures for business management and operation by more than 80 of the world's foremost authorities on these subjects.

For ease of reference, the book has been organized into seven topical sections. Subject matter includes: new techniques for management; operations within the systems and procedures department; cost reduction techniques; electronic applications and new developments; research techniques; integrated data processing and industry group and educational programs.

Case studies representing latest techniques from the petroleum and textile fields, commercial banking, plus a review of the latest ideas in property and casualty insurance is likewise included.

Brittle Behavior

Brittle Behavior of Engineering Structures, by Earl R. Parker, John Wiley & Sons, Inc., New York, 16, N.Y. 1957. Pages, 323. Price, $6.00.

The new volume was prepared for the Ship Structure Committee under the general direction of the Committee on Ship Steel, National Academy of Sciences-National Research Council.

For the engineer and metallurgist responsible for the prevention of catastrophe, the book discusses the theories and mechanism of failure, supplies a review of test methods used for evaluating relative brittleness, and interprets and summarizes test results. The author also goes into the effects of welding and composition variations on notch toughness, and supplies a report of service failures.

Written under the supervision of the Project Advisory Committee, the book was thoroughly debated in manuscript and rewritten where necessary. Chapter headings include: elementary concepts of fracture; theories of fracture; test specimens and methods; methods of interpreting test results; summary of test results on special steels; influence of chemical composition and manufacturing practice; the role of welding; residual stresses; design and workmanship; service failures in structures other than ships; and welded ship failures.

Chicago's Dream Coming True?

Is Chicago's dream of becoming the Nation's greatest city about to be fulfilled in the tremendous growth that St. Lawrence Seaway will bring?

A leading transportation authority, Marvin J. Barloon, professor of economics at Western Reserve University, Cleveland, says the answer is "not yet."

But Barloon believes the potential is there, if Chicago will only fight for improvements in the Seaway route. It has the opportunity, he says in an article in the September issue of *Harper's Magazine*, of surpassing New York as the seat of financial and commercial power if the Seaway improvements can be brought about.

Barloon points out that the Seaway will convert the U. S. shore of the Great Lakes into a new 4,300-mile North Coast, longer and vastly richer than either the Gulf Coast or the Pacific. In effect, the lakes will become "an American version of the Mediterranean Sea."

And, he says, the bonanza of the Seaway "will shower its largesse on Michigan Boulevard with a generosity unmatched" in any other city on the Lakes.

He writes: "Chicago serves the largest, richest, and most diversified hinterland of any port on the lakes, enjoys the best access to this hinterland, and suffers the least competition with the Atlantic Coast."

Barloon points out that the ports east of Chicago—Detroit, Toledo, Cleveland, Buffalo—must share their hinterland with a nearby competitor. And while Milwaukee and Duluth must be considered Chicago's competitors, neither can offer the advantages Chicago can. All the Western railroads terminate at Chicago. It is the only lake port with a major waterway leading in from her hinterland—the Illinois Waterway which connects with the Mississippi River and thereby converts the entire river system from Minneapolis to St. Louis into a continuous artery of barge transportations serving Chicago.

"Finally, bigness generates bigness," he continues. "The metropolitan area of Chicago already is the largest industrial district on the Great Lakes. With the greatest volume of traffic, Chicago can offer the most frequent sailings to the greatest number of foreign ports. She will have the most complete facilities for ship repair, outfitting, and supply. Her banks will offer the most elaborate and specialized services of foreign exchange and credit; her warehouses and waterfront installations, the most versatile accommodations. These attractions will draw shipping from the natural hinterlands of competitive ports—from Milwaukee, Detroit, and Toledo."

But, Barloon says, there are three principal drawbacks to the Seaway: (1) It will not be deep enough. (2) It will be frozen up four months of the year. (3) Its traffic will be choked in the bottleneck of the Welland Canal.

The least serious, he says, is the 27-foot depth limitation, as this will take 75 per cent of ocean freighters. The eight-month shipping season is much more serious, but the "really crippling defect" is the bottleneck at the Welland Canal between Lake Ontario and Lake Erie. Under the best conditions this cannot carry more than 50,000,000 tons of cargo annually, and much of this will be Canadian. Even if the U. S. share is three quarters of the total—37,500,000 tons—this must be distributed among all the cities on the Great Lakes. In 1955 the four major ports of the North Atlantic moved 263,000,000 tons, just seven times as much. New York alone handled four times as much.

"The new front doors from the Middle West to the world will be a narrow aperature indeed, and the manifest destiny of Chicago as the nation's greatest city must be postponed," Barloon writes.

"But perhaps not indefinitely."

The seaway can be deepened, the Welland Canal can be enlarged, and science already is making progress in keeping channels open in otherwise ice-locked waters, he says.

NSPE to Discuss Engineering Education

The role of industry and the Federal Government in financing engineering school education in the near future will be discussed by the Board of Directors of the National Society of Professional Engineers at the group's fall meeting in Bismarck, N. D., Oct. 17-19.

Discussions on engineering education will be held by the Professional Development Group of Society commitees.

At the Bismarck meeting, the NSPE Board members will also hear discussions on the implications of recent anti-union election results among engineers in industry; the outside employment of engineers employed by the Federal Government; plans for legislative action on professional standards of engineers in government agencies; and the role of the societies in engineering matters as proposed in the recent "Coover Plan" for engineering unity.

North Dakota Governor John E. Davis will speak at a banquet session on Oct. 18.

20-Year Plan

Electricity from Britain's first atom-derived electric power station at Calder Hall is coursing into the national system, reports *Chemical Week*. The Calder Hall start-up marked the first step in a 20-year atomic power program that Britain hopes will provide enough electricity to maintain expansion of power capacity in the face of the country's dwindling coal supply.

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News of Engineers

Daniel F. Darney has been appointed manager—stainless steel products division, U. S. Steel Supply Division headquarters at Chicago, it was announced by Keith P. Rindfleisch, vice president-commercial, of this United States Steel Corporation division.

A native of Pittsburgh, Pa., Darney studied at Duquesne university and the University of Pittsburgh. He began his career with U. S. Steel's former Carnegie-Illinois Steel Company in Pittsburgh as an office boy in 1937. From 1943 to 1946 he served in the U. S. Army Air Force, after which returned to the Company's sales department, where he subsequently held a number of positions.

In 1953, Darney joined U. S. Steel Supply Division in its Chicago general office as assistant to manager-stainless steel division. The following year he was transferred to the St. Paul district as product specialist-stainless steel, and in 1956 was made product representative there, the position he held until his recent appointment.

* * *

Thirty-two young Indian engineers have come to Chicago to study steel and iron production techniques as well as to learn about our way of life.

The students, selected by the Indian government and steel industry, will play a vital part in the expected tripling of India's steel production by 1961.

Ranging in age from 25 to 35, the graduate engineers have started a weekly, year-long schedule of four days' training in steel production operations at United States Steel Corp., with one day of classroom work each week at Illinois Institute of Technology.

The over-all program has been made possible by a $1,500,000 Ford Foundation grant. Numerous steel companies and technical institutes in the United States are participants.

The students arrived in Chicago Aug. 31 after a tour of New York, N. Y., Washington, D. C., and a preliminary orientation program at Carnegie Institute of Technology.

Illinois Tech will instruct the students in socio-economic orientation, managerial training, and metallurgical science.

"We shall acquaint these engineers with our American environment; our home life, our free enterprise economy, our democratic institutions and the role of management and industrial relations in a free society," said Dr. John Day Larkin, dean of liberal studies at IIT.

Raymond D. Meade, IIT extension director, will serve as program coordinator.

Metallurgical science, with emphasis on theory, will be taught by Dr. Lucio F. Mondolfo, director of the department of metallurgical engineering at IIT.

Students will live at International House, where special library facilities will be made available to them.

United States Steel Corp. will conduct the men through multi-phase steel training program to give them practical experience in steel production.

Completing the program will be a one-week trip to the ore mines in Duluth, Minn. under the auspices of Illinois Tech.

Sponsors of the program are the Ford Foundation, American Iron and Steel Institute, United Steelworkers of America, and the Indian Ministry of Iron and Steel. Participating steel companies include Bethlehem Steel Co., Inland Steel Co., Jones and Laughlin Steel Corp., National Steel Corp., Republic Steel Corp.,

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United States Steel Corp., and Youngstown Sheet and Tube Co.

Cooperating technical universities are: Carnegie Institute of Technology, Case Institute of Technology, Illinois Tech, Lehigh University, and Youngstown University.

A second group of 15 students will arrive in Chicago Nov. 31.

* * *

Paul van T. Hedden, MWSE, recent deputy director of the Department of City Planning, and former executive director of the Chicago Plan Commission, has opened his own consulting office in the fields of Industrial Planning and Zoning.

Hedden has had a long and successful career specializing in the non-residential aspects of community development. When his office was in Atlanta, Ga., he conceived and developed the Fulton Industrial district. In addition to his membership in the Western Society of Engineers in which he heads the Planning Sub-Committee of the Civic Committee, he is a member of the American Institute of Planners, the American Society of Planning Officials and the American Society for Public Administration. Hedden is a graduate of Washington & Jefferson College and Boston University Law School. He is a member of the Massachusetts Bar. He is writing a series of weekly authoritative articles on the new Chicago Zoning Ordinance which currently appears in *Realty & Building* magazine.

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Rural Electrification To be Highlighted

Latest advances in rural electrification will highlight the Third Annual Farm Electrification Conference of the American Institute of Electrical Engineers at the Hotel Nicollet, Minneapolis, Minn., Oct. 29-31. The conference is sponsored by the Minnesota Section of the AIEE and the AIEE Farm Electrification Subcommittee of the Domestic and Commercial Applications Committee.

The meeting will cover practically every engineering phase of rural electrification. Papers will be devoted largely to new developments and techniques designed to meet the challenge raised by increasing demands for electric power in rural areas. Leading electrical utilities, equipment manufacturers, rural electrification representatives and other leaders in the farm electrification field, will address the conference.

A comprehensive program has been arranged. Speakers will present information and advice on newest developments in planning rural distribution systems, rural load characteristics, farm wiring requirements, utilization of electric light, heating and air conditioning.

Morning and afternoon sessions have been arranged so as to group the subjects as closely as possible. For example, the morning session on Tuesday, Oct. 29, will be devoted to farm wiring, followed by discussions on rural systems planning in the afternoon. The agenda generally will adhere to this format, concluding with farm lighting and automatic feed handling on Thursday, Oct. 31.

On the afternoon of Oct. 30, conferees will make an inspection tour of nearby farm equipment manufacturing and industrial plants.

Records Broken

Spectacular laying of a seven-mile ocean pipeline off Los Angeles, Calif., has blasted two construction records, reports *Construction Methods and Equipment.* It is the longest and deepest major outfall ever laid. In only seven days, 11 hours, the contractor pulled a 22-inch, air-filled steel pipe into the Pacific Ocean and left it on the sandy floor 300 feet below the surface.

WSE Applications

In accordance with Article I, Section 5 of the By-Laws of the Western Society of Engineers, there is published below a list of applicants for admission received since the last issue of the MIDWEST ENGINEER magazine.

Herbert A. Ericksen, Foreman, Illinois, Bell Telephone Co., 150 S. Genesee, Waukegan, Ill.

D. F. Kolakowski, Manufacturing Engineer, Western Electric Co., Hawthorne Station.

Robert J. Wier (Rein.), Partner, Battey & Childs, 231 S. LaSalle St.

R. W. McCormick; Manager, Arch'l. Dept., Material Service Corp., 300 W. Washington St.

John J. Kelly, Jr., Research Engineer, Ditto, Inc., mail: 1316 Jenks St., Evanston, Ill.

W. F. Kuehne, Contracting Manager, Bethlehem Steel Co., Prudential Plaza.

'Engineer Leading Petroleum Industry...'

The engineer is leading the petroleum industry toward "an increase of at least 50 per cent more products and services with only 10 per cent more effort," the American Institute of Electrical Engineers' Conference of the Petroleum Industry was told in Philadelphia Sept. 11.

J. M. Crothers of the Catalytic Construction Co., Philadelphia, in a paper, "The Electrical Engineer in the Petroleum Industry," said that "established correlation between research, electronic, nuclear and power teams should produce more and better things than we have ever known (in the petroleum industry)."

Talk, he reported, is now of a four-day week. "The answer must be more automation," he said. "The electrical engineer may see into the future when the petroleum plant will be loaded with electronic devices; automatic digital computers redesigned to send control signals from precalculated programming tape; sensing devices to adjust speed of production; automatic monitoring of product analysis, and a host of unpredictable controls."

Crothers said that even now the electrical engineer is of more importance in the petroleum industry than ever before and that he works more than ever in coordination with the chemical process engineers. To illustrate, he traced the great number of responsibilities assigned to an electrical engineer at a modern new petroleum process plant project.

Asphalt Mounds May Save Beaches

Results of a successful experiment in Maryland may help U. S. coastal states reclaim and save beaches they have lost to storms, reports *Engineering News-Record*.

Since 1954, Maryland has been installing asphalt mounds that act as sand dams along its beaches. The mounds—called groins—are made of road-type hot mix asphalt and ordinary beach sand. They are 200 feet long, roughly triangular in shape and can be built for about $3,000 apiece. Construction is just a matter of hours—between tides—from start to finish.

From 1954 to 1956, Maryland spent about $130,000 on the mounds and may have saved itself nearly ten times that amount in damages from a single storm, the magazine states.

In 1956, both the Maryland and Delaware shorelines were hit by hurricane Flossie, sideswiped by another hurricane and lashed by several damaging northeast storms. After the storm season, Delaware's famed beaches, which did not have the mounds, were almost nonexistent. Maryland's equally famous Ocean City and the area to the north of it were in fine shape because of the mounds.

Since the first mound was installed in late 1954, at least six hurricanes have passed over the area, plus many northeast storms—which, in general, have done even greater beach damage than the hurricanes.

All the mounds still stand, and all — despite some breakage to their top contours — still work.

Because of the mound's solid, smooth and impervious mass, any part of the structure remaining will continue its function of accumulating sand from the ocean current. The mounds act as dams behind which ocean sand settles as waves wash over them.

Inspection of the beach in mid-Summer of 1957 showed most of the mounds to be completely invisible under the sand, though many of them were exposed during winter storms. Losses of as much as five-and-a-half feet of sand have been fully recovered.

Tide Predictor

A tide-predicting machine to aid oil firms in preparing for hurricanes along the Gulf Coast has been developed, reports *Petroleum Week*. The predictor is a basic analog computer. The machine consists of a number of knobs, and an indicator which shows the rise of the tide in a given sea.

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Underground Powerhouse being Erected

Chute-des-Passes, Quebec—A huge underground powerhouse, capable of generating a million horsepower of electricity, is under construction by Aluminium Limited at this point on the Peribonka River over 300 miles north of Quebec City.

The project involves digging a six-mile tunnel twice the width of New York's Holland tunnel to the powerhouse. Here the company will install five 200,000 horsepower generators, largest of their kind in the world, capable of producing one million horsepower of electricity. When completed, Chute-des-Passes power facilities will give Aluminium Limited a total of 4,780,000 horsepower of electricity in Canada.

The project is a part of Aluminium Limited's Canadian aluminum producing facilities. More than 15 per cent of all primary aluminum used in the United States comes from Canada.

Aluminium Limited is the parent company of Aluminum Company of Canada, Limited, and is the same corporation which built the vast subterranean hydroelectric power plant to supply power for the aluminum plant at Kitimat, British Columbia. The Chute-des-Passes power project which will cost more than $125,000,000 compares with that undertaking.

Chute-des-Passes will be the sixth hydroelectric installation built by Aluminium Limited on the Saguenay and Peribonka Rivers. The company operates aluminum smelters at Isle Maligne, Shawinigan Falls, Beauharnois and Arvida in Quebec, the latter the largest in the world, as well as the Kitimat smelter in Western Canada.

The Perini Construction Company, with two co-contractors, began work on the Chute-des-Passes project in November 1956. Access tunnels, or adits, were begun at three points along the route of the main tunnel, which will run from a storage lake to the subterranean powerhouse 6 miles down stream on the Peribonka.

Construction contractors have completed all three tunnel adits and are now excavating the main tunnel and powerhouse cavern. The powerhouse and tunnel are scheduled for completion in August 1959.

The tunnel, which will carry water at 18,000 cubic feet per second, will gradually decline to a point where the water will drop almost 636 feet vertically, to the powerhouse. There, five generators rated at 200,000 horsepower each, will be able to produce the 1,000,000 h.p.

As it has done at Kitimat and many other parts of the world where it has built aluminum producing installations, Aluminium Limited will build a new community on the site. Although all the working facilities will be nearly half a mile inside the mountain, the town will sit high on a hill overlooking the Peribonka River. The model houses, stores, schools and other facilities will be entirely electrically serviced.

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Jet Fuel in Demand

Jet fuel consumption increased seven times in the last five years, against a 40 per cent increase for aviation gasoline, reports *National Petroleum News.* Jet fuel demand is now 105-million barrels a year.

Quake Reveals Faulty Practices

Examination of many tall buildings in the business and hotel district of Mexico City, revealed that faulty design and construction practices were responsible for much of the earthquake damage, *Engineering News-Record* reported from New York on Aug. 17.

Nevertheless, there are several reasons for believing that buildings which were designed according to the highest standards and escaped this shock unscathed—including a 43-story skyscraper—may not be as fortunate in future earthquakes, says the magazine.

For one reason, there was considerable variation of shock intensity throughout the region. Due to peculiar subsurface conditions, the shock may have been more severe on some buildings than on structures a few hundred feet away.

Mexico City is located between high mountains in a wide, flat valley about 7,400 feet above sea level. Most of it is on land reclaimed by filling in Lake Toxcoco. Throughout the filled-in areas, the water level is within a few feet of the surface. It would be hard to find more difficult conditions for building. One Mexican engineer estimates that poor foundations were responsible for the damages in about half of the hard-hit buildings.

In the downtown area where most of the tall buildings are congregated, the fill extends to depths of four to 20 feet. Below, to a depth of 30 feet, are a series of alluvial and volcanic sediments. Under that, to 100 feet below grade, are thick layers of soft clay with bentonitic characteristics, separated by strata of volcanic soil. The clay has a very high water content—up to three hundred per cent (weight of water to solid matter).

The most encouraging news from earthquake-struck Mexico City, is that the city's one true skyscraper, the 43-story Latino-American tower, rode the shock waves undamaged, even to its window glass and partitions.

The height of this building, in combination with the poor foundation soils in the area, made it necessary to design a light but rigid structure.

Many tall buildings turned out to be too flexible, as evidenced by popping windows and severe partition cracking. In some cases, even the structural framing did not escape damage.

One 12-story apartment house appeared to have steel columns that were too light for the height of the building. Several buckled badly in the second story.

One lesson is obvious from inspection of the city. The quality of construction and the degree to which use is made of seismic design are more important in determining the ability of a building to survive an earthquake than materials used to build it. Steel and reinforced concrete fared equally well, if the design was good. This is proved by several high buildings that were undamaged, whereas immediately adjoining structures were hard hit.

The Federal District Building Code, dating back to 1942, contains provisions for seismic design. The July 28 earthquake demonstrated that the code provisions are inadequate, the magazine states.

Computer Conference Adds Extra Half Day

So much new technical material is available that an additional half day has been added to the 1957 Eastern Joint Computer Conference and Exhibit which will be held at the Sheraton Park Hotel, Washington, D. C., Dec. 9-13, it has been announced by the Conference Chairman, Dr. S. N. Alexander.

Dr. Alexander, who is chief of the Data Processing Systems Division, Bureau of Standards, said that this year's conference theme, "Computers With Deadlines to Meet," has aroused unusual interest and has produced a wealth of material for presentation and discussion. Nine full technical sessions, ranging from Industrial Control Computers and Instrumentation to On-Line Business Systems, are planned.

It will be the seventh Eastern Joint Computer Conference sponsored by the American Institute of Electrical Engineers, the Institute of Radio Engineers and the Association for Computing Machinery. A co-sponor this year is the National Simulation Council.

Basic purpose of the conferences is to promote and exchange information on electronic computing equipment between designers, producers, users and other interested groups.

Speaker at the Wed., Dec. 11 banquet will be E. R. Quesada, special assistant to the President for Airway Modernization.

Dr. Harry H. Goode, professor of electrical engineering, University of Michigan, is chairman of the Program Committee.

In addition to the technical sessions, there will be a large exhibit area devoted to the display of complete data processing and computing systems, as well as computer components and subassemblies.

Electronic Shorthand

The French have come up with an electronic shorthand device that may reduce the typist's and stenographer's job to a punchboard operation, reports *Electronics*. In the new process, a stiletto-like writing instrument is touched by the operator to copper contact studs labeled with shorthand symbols. The contact activates a 57-tube machine capable of storing 16 sentences in its memory and typing at the speed of the spoken word.

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